

Australian Standard[®]

Gas pool heaters



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 - Gas Appliance Manufacturers Association of Australia
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-

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Australian Standard[®]

Gas pool heaters

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PREFACE

This Standard was prepared by the Standards Australia Working Group AG-001-00-20, Gas Pool Heaters, under the responsibility of Standards Australia Committee AG-001, Gas Appliances to supersede AG 110—1998, Approval requirements for pool heaters.

This Standard incorporates Amendment No. 1 (August 2009). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected. Minor updated style changes have been made.

The objective of this Standard is to provide manufacturers, designers, regulatory authorities, testing laboratories and similar organizations with uniform minimum requirements for the safety, performance and use of gas pool heaters.

This Standard should not be regarded as a design specification or as an instruction manual.

In its preparation, consideration has been given to—

- (a) continuity of satisfactory operation;
- (b) the prevention of fire hazards, and explosions;
- (c) the prevention of injury to persons or property;
- (d) gas rules and regulations now in force; and
- (e) relevant International Standards.

AS 5601/AG 601, *Gas installations* provides essential requirements and basic standards for gas installations.

The principal differences between this edition and AG 110—1998, are—

- (i) common clauses aligned with other gas appliance (AS) Standards where appropriate.
- (ii) requirements for water temperature control clarified, and where appropriate aligned with AS 2610, *Spa pools*.
- (iii) clarification of requirements for markings and instructions, including service instructions.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

Statements expressed in mandatory terms in notes to tables and figures are deemed to be requirements of this Standard.

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STANDARDS AUSTRALIA

Australian Standard **Gas pool heaters**

SECTION 1 SCOPE AND DEFINITIONS

1.1 SCOPE

This Standard applies to gas pool heaters in which water is intended to be heated to temperatures not exceeding 60°C. These appliances are intended for use with natural gas, town gas, liquefied petroleum gas (LPG) and tempered liquefied petroleum gas (TLP) up to a gas consumption of 500 MJ/h.

NOTE: Other statutory, regulatory or health requirements may be applicable to the product(s) that fall within the scope of this Standard. It is the manufacturer, importer's or distributor's responsibility (as appropriate) to ensure that products comply with these requirements.

1.2 DEFINITIONS

1.2.1 Appliance flueway

A port or passage conveying flue gases within the appliance.

1.2.2 Appliance regulator

A device fitted to an appliance to control the gas pressure or gas volume delivered to that appliance.

1.2.3 Atmospheric burner

A burner system where all the air for combustion is introduced by the inspirating effect of a gas injector and/or by the natural draught in the combustion chamber without mechanical assistance.

1.2.4 Authority

Means the authority having jurisdiction or such authority as delegated. (Technical Regulator.)

1.2.5 Automatic burner

A burner system which, on starting, follows a self-acting sequence that has been manually or automatically initiated, to provide gas and ignition to the burner without any intermediate manual operation.

1.2.6 Automatic ignition

The lighting of gas at a burner without a manual operation whenever gas flows from the burner.

1.2.7 Available gas (Line gas)

Readily available gas with similar characteristics to the reference test gas.

1.2.8 Bleed line

A small diameter pipe or tube that conveys gas to a safe place from a diaphragm valve other than one used for pressure regulators.

1.2.9 Burner port

The opening in a burner through which gas or an air-gas mixture issues to be ignited and burned.

1.2.10 Certified

Assessed by a Certifying body, and having a certificate number to demonstrate compliance with a Standard.

1.2.11 Certifying Body

A body acceptable to the Technical Regulator that provides assurance of compliance of appliances and components with nominated standards or other accepted safety criteria.

1.2.12 CO/CO₂ ratio

The ratio by volume of carbon monoxide to that of carbon dioxide in the combustion products.

1.2.13 Combination temperature and pressure relief valve

A valve that functions in response to both excessive temperature and pressure.

1.2.14 Combustible materials

Materials made of or surfaced with wood, compressed paper, plant fibres or other materials that will ignite and burn.

1.2.15 Combustion chamber

The main firing chamber of the water heater excluding subsequent passages.

1.2.16 Combustion products

Constituents resulting from the combustion of a fuel with oxygen, including the inerts associated with the fuel and the oxygen but excluding any other diluent or contaminant.

1.2.17 Cross lighting

Lighting of one burner from another either directly or by means of an intermediate flame.

1.2.18 Determined gas consumption

Gas consumption rate, measured in megajoules per hour, using reference gas at specified test pressures and with ambient conditions corrected to standard temperature and pressure.

1.2.19 Drain valve

A valve in the bottom of the water vessel, through which the water may be drained from an appliance.

1.2.20 Draught diverter

A device, without moving parts, fitted in the flue of an appliance for isolating the combustion system from the effects of pressure changes in the secondary flue.

1.2.21 Excess air

Air in excess of that required for complete combustion that is mixed unchanged with the combustion products, in the combustion chamber.

1.2.22 Flame abnormality

A flame condition that results in lifting, floating, lighting back, appreciable yellow tipping, carbon deposition or objectionable odour.

1.2.23 Flame establishment period

The period that begins when the fuel valve is energized and ends when the flame supervision system is first required to supervise that flame.

1.2.24 Flame failure response time

The time taken for the flame safeguard to detect loss of flame and de-energize the shut off valve.

1.2.25 Flame proving period

The supervised period following the flame establishment period and before any further operation other than shutdown is permitted.

1.2.26 Flame safeguard

A safety device that automatically cuts off the gas supply if the actuating flame is extinguished.

1.2.27 Flame safeguard system

A system consisting of a flame detector(s) plus associated circuitry, integral components, valves and interlocks the function of which is to shut off the fuel supply to the burner(s) in the event of ignition failure or flame failure.

1.2.28 Flash lighting tube

A device for igniting a gas burner in which a flame is made to travel to the burner ports through a tube in which an inflammable mixture of gas and air has been induced.

1.2.29 Flue

The passage through which flue gases are conveyed from an appliance to a discharge point, excluding draught diverter, barometric device, fan or similar part.

1.2.30 Flue connection

A device incorporated in an appliance for the connection of a flue or draught diverter, barometric device, fan or similar part.

NOTE: Where the draught diverter, barometric device, fan or similar component is an integral part of the appliance, the discharge point of the integral part shall be deemed to be the flue connection.

1.2.31 Flue gases

Combustion products plus all diluents and contaminants intermixed with the combustion products. These include, where applicable, excess air, dilution air, process air, and waste products from the process.

1.2.32 Flue system

The passage through which flue products are conveyed from an appliance to a discharge point including draught diverter, barometric device, fan or similar part.

1.2.33 Flue terminal

The point at which flue products discharge from a flue. It is the point where a flue system discharges into a flue cowl (if fitted).

1.2.34 Forced draught burner

A burner system where all or part of the air for combustion is provided under pressure.

1.2.35 Gas

A combustible fuel gas that may be one of the following:

1.2.35.1 Natural gas (NG)

A hydrocarbon gas consisting mainly of methane.

1.2.35.2 Simulated natural gas (SNG)

A gas comprising a mixture of LPG and air, in the approximate proportions of 55% gas and 45% air for commercial propane.

1.2.35.3 Town gas (TG)

A gas manufactured from coal or petroleum feedstocks.

1.2.35.4 Tempered liquefied petroleum gas (TLP)

A gas comprising a mixture of LPG and air, in the approximate proportions of 27% gas and 73% air for commercial propane.

1.2.35.5 Liquefied petroleum gas (LPG)

A gas composed predominantly of any of the following hydrocarbons, or any combination of them in the vapour phase: propane, propene (propylene), butane, butene (butylene).

1.2.36 Gas consumption

The rate of energy consumed by an appliance under specific conditions and expressed in megajoules per hour (MJ/h).

1.2.37 Heating value gross, (at constant pressure)

The number of megajoules liberated when one cubic metre of dry gas, at standard conditions of temperature (15°C) and absolute pressure (101.325 kPa), is completely burnt in air with all the water formed by the combustion process in the liquid state and with the products of combustion at standard conditions.

NOTE: Calculation of heating value is based upon ISO 6976 as given in AS 4646.

1.2.38 Induced draught burner

A burner system where all or part of the air for combustion is introduced by providing suction in the combustion chamber by mechanical means.

1.2.39 Injector

A device that causes air to mix with a stream of gas. In the case of an aerated burner it incorporates an orifice discharging gas into the mixing throat or tube.

1.2.40 Intermittent pilot

A pilot that is automatically ignited each time the burner is started, and which is automatically extinguished with the main burner.

1.2.41 Interrupted pilot

A pilot that is automatically ignited each time the burner is started, and which is automatically extinguished at the end of the main flame establishment period.

1.2.42 Jointing compound

A manufactured liquid, paste-like or semi-solid material used to seal joints.

1.2.43 Light back

Transfer of the flame from burner port(s) into the body of the burner or back to the injector.

1.2.44 Limit device

A device that is actuated by the approach to a hazardous situation in an appliance due to abnormal conditions, and when actuated, causes the gas supply to all burners to shut off with lockout.

1.2.45 Lockout

A safety shutdown condition of the control system that requires a manual reset in order to restart.

1.2.46 Lower explosive limit (LEL)

The lowest percentage of gas in air in which combustion can be self-sustaining at standard temperature (15°C) and absolute pressure (101.325 kPa) conditions.

1.2.47 LPG

See Gas.

1.2.48 Maintenance gas consumption

The gas consumption per hour required to maintain at a steady value some particular condition in an appliance, e.g. to hold a specified temperature evenly.

1.2.49 Manual ignition

1.2.49.1 Direct manual ignition

The lighting of a burner by the use of a hand held ignition device.

1.2.49.2 Remote manual ignition

The lighting of a burner by a manual operation where the ignition activating device is remote from the ignition point.

1.2.50 Maximum working water pressure

The pressure setting of the water pressure relief valve or its equivalent.

1.2.51 Minimum working water pressure

The minimum pressure required to operate the water operated gas valve.

1.2.52 Mixing tube

That part of an atmospheric burner in which the air and gas are mixed.

1.2.53 Natural draught burner

See Atmospheric burner.

1.2.54 Natural gas

See Gas.

1.2.55 Nominal gas consumption

The appliance gas consumption, in megajoules per hour, as stated in manufacturer's specifications, data plates, instructions and general communications.

NOTE: This is the fundamental quantity on which all Methods of Test are based and is the starting point for all performance requirements.

1.2.56 Nominal test point pressure

The gas pressure specified by the manufacturer, at which the appliance is designed to operate, and measured at a test point.

1.2.57 Normal test gas pressure

0.75 kPa for TG and TLP, 1.13 kPa for NG and SNG, 2.75 kPa for LPG.

1.2.58 Open flued appliance

An appliance designed to be connected to an open flue system, its combustion air being drawn from the room or space in which it is installed.

1.2.59 Outdoor appliance

An appliance designed for outdoor installation or use.

1.2.60 Permanent pilot

A pilot that is permanently alight while the appliance is in service and which is controlled independently of the main burner.

1.2.61 Pilot

A permanently located burner independent of the main burner, small in relation to it, and arranged to provide ignition for the main burner.

1.2.62 Pool heater

An appliance designed for heating water in a swimming pool, spa pool or similar body of water.

1.2.63 Pool heating system

A system of components to enable controlled heating of a spa pool, swimming pool or similar body of water. The system may comprise heater, circulating pump and controls.

1.2.64 Primary air

That portion of the total air required for combustion that is mixed with the gas prior to burning on the burner ports.

1.2.65 Primary air ports

The openings in an aerated burner for primary air.

1.2.66 Primary flue

That portion of the flue system conveying flue products from an appliance to the draught diverter, barometric device, fan or similar part when fitted.

1.2.67 Programmable electronic system (PES)

A system based on one or more central processing units (CPUs), connected to sensors and/or actuators, for the purpose of control, protection or monitoring.

NOTES:

- 1 The term PES extends to and includes all elements in the system such as—
 - (a) sensors and/or other input devices;
 - (b) data links and/or other communication paths; and
 - (c) actuators and/or other output devices.
- 2 The term PES includes system software such as executive, users and communication, etc. which is configured to operate a process.
- 3 The term PES is used to cover systems incorporating a wide range of programmable electronic devices and includes systems incorporating—
 - (a) microprocessors;
 - (b) Programmable Controllers (PCs);
 - (c) Programmable Logic Controllers (PLCs);
 - (d) Programmable State Controllers;
 - (e) other computer based devices.
- 4 A PES can include a microprocessor-based temperature, pressure, air/fuel ratio, or level controller or monitor.

1.2.68 Purge volume

The purge volume includes the combustion chamber and all areas where combustion products and combustible vapours, dusts or gases may accumulate in the appliance or process up to the vertical connection of a flue or chimney that discharges directly to atmosphere.

1.2.69 Reference gas

The gas corresponding to an average of the gases most currently distributed, and for which the appliance has been specifically designed. See Test gases.

1.2.70 Relative density

The ratio of the mass of a volume of gas to the mass of the same volume of dry air under the same conditions of temperature and pressure.

NOTE: Calculation of relative density is based upon ISO 6976 as given in AS 4646.

1.2.71 Room sealed appliance

An appliance designed such that air for combustion does not enter from, or combustion products enter into, the room in which the appliance is located.

1.2.72 Safety shutdown

The action of shutting off all gas and ignition energy by means of a safety control such that restart cannot be accomplished without a full start cycle.

1.2.73 Safety shut off system

An arrangement of valves and associated control systems which shuts off the supply of gas when required, by a device that senses the approach to an unsafe condition.

1.2.74 Safety shut off valve

An automatic valve used to shut off gas supply to an appliance when a signal is generated indicating the approach to an unsafe condition.

1.2.75 Secondary flue

That portion of the flue system conveying flue products from the draught diverter, barometric device, fan or similar part to the flue terminal.

1.2.76 Simulated natural gas (SNG)

See Gas.

1.2.77 Spa pool

A water retaining structure with a capacity of not less than 680 L with which is associated the facility for heating the water contained in it and injecting air bubbles or jets of turbulent water.

1.2.78 Specific gravity

See Relative density.

1.2.79 Spillage

A condition in which the combustion products are not cleared by the flue, but escape from the appliance or the draught diverter relief openings.

1.2.80 Start gas

The gas flowing at a pilot burner or, when no pilot burner is fitted, at a main burner during the flame establishment period for initial ignition.

1.2.81 Storage water heater

A water heater in which a hot water storage vessel is built into the appliance as an integral part.

1.2.82 Swimming pool

Any structure capable of being filled with water to a depth greater than 300 mm and primarily intended to be used for swimming, wading or paddling.

1.2.83 Temperature limit device

A device that automatically interrupts the heat flow when the temperature at the control point reaches a predetermined limit.

1.2.84 Tempered liquefied petroleum gas (TLP)

See Gas.

1.2.85 Terminal

See Flue terminal.

1.2.86 Test gases

The test gases used in these requirements are defined in the Test Gas Table (Table 1.1) that is based on pure components. Actual test gases are made up using constituent test gases of the purities listed below to the respective Wobbe Index $\pm 2\%$. Purities of the constituent gases are to be not less than:

- (a) 99% for hydrogen and nitrogen
- (b) 95% for methane ($H_2 + CO + O_2 < 1\%$, $N_2 + CO_2 < 2\%$)
- (c) 95% for propane ($H_2 + CO + O_2 < 1\%$, $N_2 + CO_2 < 2\%$)
- (d) 95% for propylene ($H_2 + CO + O_2 < 1\%$, $N_2 + CO_2 < 2\%$)
- (e) 95% for butane ($H_2 + CO + O_2 < 1\%$, $N_2 + CO_2 < 2\%$)

Where base gases of the required composition or purity are not readily available, suitable blended gases of the same Wobbe Index and other combustion characteristics may be used. In case of dispute, the purity of the constituent gases shall not be less than the above values.

1.2.87 Thermostat

A device that automatically maintains a pre-determined temperature in an appliance or component.

1.2.88 Thermostat bypass

An integral part of a thermostat control that enables a preset volume of gas to bypass the thermostat valve.

1.2.89 Town gas

See Gas.

1.2.90 Turndown gas consumption

The lowest gas consumption to which the burner control can be set.

1.2.91 Unvented water heater

A water heater in which no provision is made for a vent permanently open between the water circuit and atmosphere.

1.2.92 Water heater

An appliance for the supply of water at a temperature not exceeding 99°C.

1.2.93 Water operated gas valve

A gas valve actuated by a flow or change of pressure in a water system of an appliance.

1.2.94 Water pressure relief valve

A pressure actuated valve that automatically discharges fluid at a specified set pressure. It is fitted to heaters to prevent the pressure in the container from exceeding the maximum working pressure during normal use and from exceeding a predetermined margin over the maximum working pressure when temperature controls fail to limit pressure.

1.2.95 Wobbe index (wobbe number)

The Wobbe index of a gas is—

$$\frac{\text{Heating value}}{\sqrt{\text{Relative density}}}$$

TABLE 1.1
TEST GAS TABLE

Test gas	Application	Composition percent							*Characteristics		
		Hydrogen	Methane	Propane	Propylene	Butane	Nitrogen	Air	Heating value MJ/m ³	Relative density	Wobbe index MJ/m ³
N	NG	—	97.5	1	—	—	1.5	—	37.8	0.571	50.0
Na		—	86	14	—	—	—	—	45.7	0.692	55.0
Nb		13	87	—	—	—	—	—	34.4	0.492	49.1
Nc		—	90	—	—	—	10	—	34.0	0.596	44.0
S		—	—	55	—	—	—	45	52.1	1.296	45.7
X	LPG	—	—	100	—	—	—	—	95.8	1.553	76.9
Y		—	—	—	—	100	—	—	125.7	2.078	87.2
Z		—	—	—	100	—	—	—	88.5	1.476	72.9
T	TLP	—	—	27	—	—	—	73	25.4	1.142	23.8
Ta		—	—	29	—	—	—	71	27.3	1.153	25.5
Tb		—	—	25	—	—	—	75	23.6	1.131	22.1
A	TG	50	—	18	—	—	32	—	23.0	0.619	29.2
B		65	—	7	—	—	28	—	14.5	0.423	22.2
C		28	—	18	—	—	54	—	20.3	0.817	22.5
D		50	—	15	—	—	35	—	20.2	0.602	26.0

* The reference conditions for the characteristics are 15°C, 101.325 kPa, Dry. The test gases shall be of a composition and of combustion characteristics as shown in the table. Where base gases of the required combustion purity are not available suitably blended gases of the same Wobbe index and other combustion characteristics may be used. In case of dispute gases strictly shown in the table shall be used.

NOTE: The listed characteristics for test gas 'Y' are based on the properties of iso-butane.

SECTION 2 DESIGN AND CONSTRUCTION

2.1 GENERAL

2.1.1 Preliminary specification

Testing shall not commence until the manufacturer's written description of the appliance and instructions for installation and operation, sufficient for testing, have been received and studied. The appliance shall not be dismantled for specification study until testing has been completed.

2.1.2 Physical inspection

Before any physical performance testing, the appliance must satisfy the requirements as set out in this section to ensure that it does not possess any obvious features that would prevent its certification. If the appliance is not considered satisfactory, adjustments must be made prior to the commencement of testing.

2.1.3 Certification of safety components

All components relating to the safety of the gas burning operation shall be separately certified, or shall be certified as part of the appliance against the requirements of the relevant component Standard(s).

NOTE: This includes, for example, automatic ignition systems, flame safeguards and pressure switches, whether or not these carry gas.

2.1.4 Programmable electronic systems

Where a Programmable Electronic System (PES) is employed for safety related functions of burner management systems, the PES shall meet the requirements of (a) or (b) below:

- (a) Conform to the relevant requirements of AG 210 (to be AS 4625) and EN 298 (or equivalent).
- (b) Be certified by a body recognized by the Certifying Body to the requirements of AG 210 (to be AS 4625) and EN 298 (or equivalent).

2.1.5 Manual shut off valves

Manual shut off valves fitted to an appliance shall be certified as Type 1 or Type 2 in accordance with the classification specified in AG 201 (to be AS 4617).

2.1.6 Classification of safety shut off valves

Where a safety shut off system is required, the minimum classification of the safety shut off valve fitted shall be selected in accordance with Table 2.1.

TABLE 2.1
SAFETY SHUT OFF VALVE(S) SELECTION AND CLASSIFICATION

Burner type	Standard and classification
Atmospheric	AG 204 (to be AS 4620) or AG 214 (to be AS 4629) Class 3
Induced draught	AG 214 (to be AS 4629) Class 3
Forced draught with air pressure not exceeding 3 kPa	AG 214 (to be AS 4629) Class 2
Forced draught with air pressure exceeding 3 kPa	AG 214 (to be AS 4629) Class 1

NOTE: Refer to Clause 2.8.1 for fitting of safety shut off systems.

2.1.7 Power failure

During a power failure the appliance shall not be activated automatically when the gas controls are in the 'OFF' position.

2.1.8 Continuation of satisfactory operation

Construction of the appliance shall be such that continuity of satisfactory operation can be expected during normal usage.

2.1.9 Compliance in alternative forms

If an appliance is so designed that certain components may be fitted or omitted, the appliance shall comply with all requirements of this Standard in its alternative forms.

2.1.10 Alteration of programmed ignition

Adjusting devices for programmed ignition shall be sealed against unauthorized alteration to settings.

2.1.11 Means for gas pressure measurement

Means shall be provided to allow the gas pressure to be measured, and where means for adjustment is provided, adjusted while the appliance is in operation.

Pressure test points shall contain a limiting orifice not exceeding 0.7 mm or equivalent restriction.

2.1.12 Protection of vitreous enamel

Screw heads in contact with cover coat vitreous enamel shall be provided with means of preventing enamel damage.

This provision is optional in the case of ground coat or wiped areas.

2.1.13 Gas consumption adjusting devices

Gas consumption adjusting devices where provided shall be sealed against unauthorized alteration to setting.

2.2 STRENGTH AND STABILITY

2.2.1 Adequacy of means of support

The appliance shall be provided with adequate means of support, which shall not allow the appliance to rock on a level surface or to have sharp edges in contact with the floor.

2.2.2 Support of components

Pilot burners, igniters and flame sensing devices shall be supported in such a manner that their position relative to each other and the main burner(s) shall remain fixed.

2.2.3 Location of burner mixing tubes

Burner mixing tubes shall be positively located in relation to gas injectors. Where a mixing tube rests on an injector, provision shall be made to prevent the mixing tube from interfering with the correct functioning of the valve or injector.

2.2.4 Burner supports

Burner supports shall be such that the burners cannot be easily displaced in normal usage.

2.2.5 Gas manifolds

Gas manifolds shall be firmly fixed to prevent displacement during handling or installation.

2.3 MATERIALS AND STANDARDS

2.3.1 Suitability of materials and finishes

Materials and finishes, including dressings and lubricants used in the construction of an appliance shall be suitable for the conditions of use, e.g. corrosion, temperature, handling, etc.

2.3.2 Materials containing asbestos

Materials containing asbestos are prohibited.

2.3.3 Materials in contact with gas

Materials in contact with gas shall be suitable for all gases.

2.3.4 Materials used in appliances

Materials used in gas appliances shall comply with the following, or equivalent, where applicable:

- (a) Medium or higher grades of black steel pipe to AS 1074.
- (b) Copper-brazed double wall low carbon steel tubing (Bundyweld) to AS 1751. This shall be lead-tin coated or equivalent where corrosion protection is necessary.
- (c) Welded and cold drawn low carbon steel tubing to AS 1450 (S.A.E.-525B).
- (d) Copper pipe to AS 1432.
- (e) Stainless steel tubing to AS 1769 i.e. grade 304 to AS 1449.
- (f) Cast iron fittings to AS 1832. Threads to AS 1722.1.
- (g) Flanges in cast iron, carbon steel, steel alloy or copper alloy to AS 2129.
- (h) Steel fittings to AS D26.
- (i) Copper alloy fittings to AS D26.
- (j) Copper alloy fittings to AS 3688.
- (k) Copper capillary fittings to AS 3688 with silver brazing rod to AS 1167.1, Table 2, alloy designation B2 or a comparable rod.
- (l) Anode materials used in vitreous enamelled storage water heaters shall comply with AS 1056.1.

2.3.5 Zinc based alloys

Zinc based alloys shall not be used in contact with water. Where zinc-based alloy is used in any way that may affect the safe operation of the appliance—

the alloy shall comply with AS 1881 – TYPE ZN AL 4;

the temperature in use shall not exceed 80°C; and

the alloy shall not swell, crumble or develop cracks when exposed to saturated water vapour at 97°C for 10 d.

2.3.6 Thermal insulation

Thermal insulation shall—

- (a) not contaminate water in the appliance, nor produce obnoxious odours, fumes, nor corrode materials with which it is in contact;
- (b) be fitted in such a way that it is not rendered ineffective or objectionable by—
 - (i) settling;
 - (ii) dislodgment; or

- (iii) condensation during the normal operation of the appliance; and
- (c) be protected against rodents, birds, etc.

2.3.7 Compression fittings

Compression fittings on gas lines shall comply with the following conditions:

- (a) They shall be made so that the mating surfaces shall be compatible.
- (b) The nominal outside diameter of the tube shall not exceed 20 mm.
- (c) Loose olives, where used, shall be symmetrical to prevent incorrect assembly.
- (d) Shear olives, where used, may be asymmetrical.
- (e) After making and breaking the fittings ten times, applying the torque value as listed in Table 2.2 to remake the fittings, the joints shall comply with the requirements of Clause 3.3.
- (f) The component parts shall be made of materials with a melting point not less than 430°C.

TABLE 2.2
TORQUE VALUES

Nominal size mm	Torque Nm
6	15
8	20
10	35
15	50
20	75

2.3.8 Components required to be placed in a flame

Pilot burners, thermocouples and other components required to be placed in a flame shall be resistant to the effects of heat and corrosion. When refractory alloys are used they shall not produce a catalytic effect. Nickel alloys having less than 1% nickel such as AISI 416/SUS 416 steel shall be acceptable.

2.3.9 Protection of aluminium tubing

Aluminium tubing in areas of restricted ventilation shall be provided with a protective barrier to prevent corrosion due to contact with condensation, insulation and other materials of the appliance.

2.3.10 Materials used in electrical construction

Materials used in the electrical construction shall be suitable for the application, in particular:

- (a) Electrical insulation shall be of a moisture resistant material.
- (b) High-tension wiring shall be temperature resistant.
- (c) Insulation shall have adequate mechanical and dielectric strength.

2.3.11 Copper alloy components in contact with water

Copper alloy components in contact with water shall be resistant to the effects of dezincification in accordance with AS 1056.1.

2.3.12 Materials for attachment of water coils to combustion chamber walls

Material for the attachment of water coils to combustion chamber walls shall have a melting point of not less than 500°C.

2.3.13 Construction of primary air controls

Primary air control(s) where fitted should be constructed of rust resistant finish except when the type of material of construction employed will prevent sticking or corroding in position. Cast iron air shutters are considered acceptable.

2.3.14 Design of appliance base

The base of an appliance intended to stand on surfaces that may become wet shall be designed to resist corrosion of the base material.

2.4 ELECTRICAL REQUIREMENTS

2.4.1 Connection to the mains electrical supply

Appliances intended for connection to the mains electrical supply shall be designed for 240 v single phase or 415 V three phase, 50 Hz a.c.

2.4.2 Requirements for electrical components and their installation

Electrical components, and their installation in the appliance, shall comply with the requirements of the appropriate electrical authority. Documentary evidence of suitability of electrical components shall be provided to the Certifying Body.

2.4.3 Accessibility to electrical components

Accessibility shall be provided to adequately service the electrical installation in the appliance.

2.4.4 Connection of electrical components

Electrical components or assemblies which may be required to be removed from an appliance shall not be connected by permanent or soldered joints, except in the case of extra-low voltage circuits (as defined in AS/NZS 3000).

2.4.5 Plug and socket connections

Multiple pin plug and socket connections of electrical components within the appliance shall not be interchangeable.

2.4.6 Protection against accidental contact

Electrical parts other than extra-low voltage terminals shall be enclosed to provide protection against accidental contact. Checking shall be in accordance with AS/NZS 3100.

2.4.7 Protection of low voltage electrical components and wiring

Low voltage electrical components and wiring, if required to be energized to permit servicing of gas components on the appliance, shall be adequately protected against accidental contact. Checking shall be in accordance with AS/NZS 3100.

2.4.8 Protection of wiring and controls against weather conditions

Appliances shall have all controls and electrical wiring adequately protected from damage and weather conditions to ensure safe and reliable operation.

2.5 INSTALLATION REQUIREMENTS

2.5.1 Fixing of gas inlet connection

For appliances that are designed to be connected to a fixed gas supply system, the gas inlet connection shall be firmly fixed. The regulator, where fitted, shall be anchored to prevent rotation while making the connection. This requirement shall be deemed to be met if the regulator can be held in position by means of a spanner while making the connection in accordance with the manufacturer's instructions.

2.5.2 Gas connection thread

The gas inlet connection shall have a thread in accordance with the appropriate part of AS 1722.

2.5.3 Water inlet and outlet connections

Water inlet and outlet connections shall be suitable for available standard fittings.

2.5.4 Access to gas and water connection

Gas and water connections shall be so located that sufficient free space is available for the connections to be made or disconnected, using normal tools.

2.6 FLUEING REQUIREMENTS

2.6.1 Appliance flue requirements

Natural draught appliances designed for indoor installation shall be flued and except those with balanced flues shall be supplied with draught diverters as essential components by the manufacturer.

Forced and induced draught appliances designed for indoor installation shall be flued.

2.6.2 Design of air entry and combustion product discharge

Appliances shall be so designed that flue way terminals, draught diverter relief openings and openings for the entry of air for combustion are part of the appliance structure and, are unlikely to be obstructed by cabinets, walls or partitions on or in which the appliance is installed. In the case of appliances specifically designed to be built-in, any clearance necessary to the safe and effective operation of the appliance shall be ensured by means of permanently attached spacers.

2.6.3 Design of flue connection

The flue connection shall provide means to prevent partial or complete blockage of flue ways caused by the fitting of a flue pipe.

2.6.4 Flue adaptors

Flue connections, both vertical and horizontal, for an appliance shall be designed to accommodate both single wall and twin wall circular or rectangular metal flue pipe. The use of an adaptor to achieve this purpose will be considered satisfactory.

Flue connections or adaptors designed for twin metal flue pipe shall comply with the requirements of AG 605 (to be AS 4567).

Flue connections or adaptors designed for single wall metal flue pipe shall conform to the dimensions given in Table 2.3 and 2.4.

2.6.5 Design of flue connection—engagement

In all cases, the minimum length of engagement shall not be less than 13 mm for vertical flue connection and 25 mm for horizontal flue connection.

TABLE 2.3
CIRCULAR FLUE CONNECTION

Nominal pipe diameter mm	Diameter of flue connection mm	
	Internal dimension of socket	External dimension of spigot
75	78 ⁺³ ₋₀	73 ⁺⁰ ₋₃
100	104 ⁺³ ₋₀	98 ⁺⁰ ₋₃
125	129 ⁺³ ₋₀	123 ⁺⁰ ₋₃
150	153 ⁺³ ₋₀	148 ⁺⁰ ₋₃

TABLE 2.4
RECTANGULAR FLUE CONNECTION (SPIGOT)

Nominal size mm	Dimensions of flue connection mm	
	Width	Depth
250 × 50	247 ⁺⁰ ₋₅	45 ⁺⁰ ₋₅
300 × 65	295 ⁺⁰ ₋₅	60 ⁺⁰ ₋₅

2.6.6 Flue terminal and draught diverter construction

Flue way terminals and draught diverters shall be constructed so that they cannot be installed in other than the correct position.

2.6.7 Protection against entry of birds in flue terminal

In order to ensure against the entry of birds, no opening of the flue terminal shall permit the entry of a ball of 16 mm diameter.

2.7 MAINTENANCE REQUIREMENTS

2.7.1 Insertion and removal of gas injectors

Removable gas injectors shall be made so that they can be inserted and removed without damage.

2.7.2 Positive location of flash tubes

Flash (or cross lighting) tubes shall be positively located in relation to source of ignition and flame ports, so as to prevent misalignment, or rendering of the lighting system inoperative, by normal handling, dismantling or reassembling, or cleaning of the appliance.

2.7.3 Assembly and attachment of handles, dials and pointers

Valve handles, movable dials and pointers shall be so designed that they are not capable of being incorrectly assembled, shall be securely attached to their spindles and shall not contain loose parts which may become detached when they are removed.

2.7.4 Accessibility for adjustment

Components and integral parts that may require adjustment shall be accessible for such adjustment. In particular the following shall be readily and easily adjusted without risk of injury while the appliance is installed and operating:

- (a) Aeration controls. (It is acceptable for the adjustment to be finalized with the burner removed, provided the setting will not be disturbed during replacement).
- (b) Pilots.
- (c) Thermostat bypasses where provided.
- (d) Thermostat calibration.
- (e) Regulator adjustments.
- (f) Ignition devices.
- (g) Safety devices.
- (h) Gas consumption adjusters.
- (i) Slow lighting adjusters.
- (j) Water flow rate controls.

2.7.5 Accessibility for replacement

Components that require to be removed for service shall be so made and attached to the appliance that they can be removed and replaced without undue force. In particular, except in the case of appliances readily disconnected and easily handled by one person, the following components shall be readily removed from and replaced in the appliance without undue force or risk of injury and without moving the appliance from the installed position:

- (a) Regulator components (except body).
- (b) Gas valve plugs.
- (c) Injectors.
- (d) Filters (gas and water).
- (e) Pilot head assemblies, pilot injectors.
- (f) Clocks and timers.
- (g) Door springs or other door control mechanisms.
- (h) Ignition devices.
- (i) Automatic control equipment.
- (j) Flame safeguards.
- (k) Safety shut off systems.
- (l) Fans, electric motors and drives.
- (m) Burner(s).
- (n) Printed circuit boards.
- (o) Flue baffles when flue cleaning is necessary.
- (p) Slow lighting adjusters.
- (q) Thermostats complete including sensing elements. Thermostat valve plug and bypass adjuster to be separately removable.
- (r) Water-operated gas valve assemblies.

- (s) Heat exchanger units of instantaneous multipoint water heaters.
- (t) Drip trays.

2.7.6 Screwed connections

Components and assemblies of components with screwed connections shall be provided with flats for spanners unless accessible unions are provided on inlet and outlet connections.

2.7.7 Inaccessible nuts or bolts

Nuts or bolts in inaccessible positions securing parts requiring to be removed for service shall be captive.

2.7.8 Provision for draining

Appliances shall have provision for draining the appliance. Appliances in excess of 200 L capacity shall be provided with a hand-operated drain valve.

2.7.9 Collection and removal of corrosion product

Access shall be provided for the collection and removal of corrosion product.

2.7.10 Provision for descaling the circulation system

Adequate provision shall be made for descaling the water sections or pipes in the circulation system of the unit.

2.8 GAS CONTROLS, FLAME SAFEGUARDS AND RELIEF DEVICES

2.8.1 Fitting of flame safeguards

A flame safeguard system shall be fitted to every appliance so that, in the event of flame failure at the point of supervision, the flame safeguard system shall shut off all the gas to the appliance. However, natural draught appliances designed for room sealed or external installation, and operating on natural gas, may have an unprotected pilot with rate not exceeding 0.5 MJ/h.

2.8.2 Main burner automatic shut off valves

All gas to the main burner shall pass through at least two automatic valves in series that may or may not be in a single control body. One valve shall be actuated by the pool temperature control thermostat and the other by the device specified in Clause 2.8.8 unless both devices control both valves.

2.8.3 Temperature controlled thermostat

A pool temperature control thermostat and its associated sensor(s) shall be provided and fitted as an integral part of the appliance.

2.8.4 Reignition of thermostatically controlled burners

Thermostatically controlled burners shall include means to ensure automatic reignition of the burner. However, safety shut off valve(s) shall not be bypassed.

2.8.5 High temperature limit device

Each appliance shall be supplied with a manual reset high temperature limit device, independent of the appliance temperature control thermostat. This shall either shut off the gas supply to the burner or switch off the circulating pump.

The manual reset high temperature limit device shall not operate on the same valve as the appliance control thermostat unless both devices control at least two valves in series.

2.8.6 Protection of appliance due to abnormal conditions

When the appliance is installed according to manufacturer's instructions, provisions shall be made to protect the unit, as a result of—

- (a) abnormal water flow conditions due to blockage, closure of any valve, failure of a pump etc; or
- (b) failure of the normal temperature control device.

The control system shall be so designed that in the event of a failure of any of its equipment the main burner gas supply is cut off before any damage to the unit can occur.

2.8.7 Relief valves for unvented appliances containing more than 1 litre of water

Each unvented appliance containing more than 1 litre of water shall be supplied with one or more certified relief valves of the types and ratings listed below, with a pressure setting not exceeding the maximum working pressure of the water heater which shall be either—

- (a) a combination temperature and pressure relief valve complying with AS 1357.1 and having a rating, in kilowatts, not less than $0.21 \times \text{Gas Consumption (MJ/h)}$; or
- (b) a pressure relief valve complying with AS 1271 and having a total steam discharge capacity, in kilograms per hour, not less than $0.34 \times \text{Gas Consumption (MJ/h)}$.

NOTE: A rating in kilowatts of $0.21 \times \text{Gas Consumption (MJ/h)}$ is the equivalent in energy of a steam rating in kilograms per hour of $0.34 \times \text{Gas Consumption (MJ/h)}$.

The valves shall be located within 150 mm of the top of the water container or top 20% of the water capacity whichever is the higher. In the case of instantaneous water heaters, fitting the valves in the plumbing immediately adjacent to the outlet will be deemed to comply with the requirement.

2.8.8 Temperature limit devices

An appliance shall be fitted with a temperature limit device, the device, including its sensor(s) shall be—

- (a) actuated by water temperature; and
- (b) an integral part of the appliance.

The device shall operate independently of the appliance temperature control thermostat.

2.8.9 Power failure

Failure of electricity supply at any stage shall result in safety shutdown.

2.9 IGNITION, PILOTS AND MAIN BURNERS

2.9.1 Pilot burner shut off

Means shall be provided for shutting off the gas supply to a pilot burner.

2.9.2 Viewing of burner flames

It shall be possible to view burner flames either directly or by use of a mirror with a panel or part removed.

2.9.3 Protection of ports and injectors

Any ports and injectors of main and pilot burners that may be exposed in their normal operation to falling particles shall be protected against blockage.

2.9.4 Restriction on gauze over primary air ports

Gauze shall not be fitted over primary air ports of burners other than pilot burners.

2.9.5 Pilot gas filter

Gas filters shall be provided for continuously burning pilots of 0.5 MJ/h or less capacity (optional for LPG).

2.9.6 Aeration adjustment for universal LPG appliances

For universal LPG appliances, burner primary aeration shall be non-adjustable.

A1 | 2.10 GAS CONTROLS, SAFETY SHUT OFF SYSTEMS AND MEANS OF IGNITION

2.10.1 Safety shut off valves

An automatic shut off valve(s) shall be connected in the safety shut off system in such a manner that it will shut off when an unsafe condition develops.

2.10.2 Failure of pilot burner

Failure of any pilot burner shall cause the safety shut off valves(s) to close.

2.10.3 Means of ignition for outdoor or room sealed appliances

In the case of an outdoor or room sealed appliance the means of ignition shall be incorporated as part of the appliance.

2.11 DESIGN FOR USE

2.11.1 Accessibility by the user

Controls and working parts shall be accessible and easily operated by the user.

2.11.2 Accidental change of setting

Gas valves, movable dials and pointers shall be designed or located so as to avoid accidental change of setting in use.

2.11.3 Adjusting devices, locking arrangements

Adjusting devices shall be provided with locking arrangements that shall be sufficiently positive to prevent subsequent movement, either through accident or through the creep of sealing material. The tightening of a locking device shall not alter the setting.

2.11.4 Burners with manual ignition

The remote manual ignition of a burner, including pilots, shall be visible or visibly indicated to the user while operating the ignition devices and the appropriate gas controls.

The direct manual ignition of a burner, including pilots, shall be accessible and visible while operating the appropriate gas controls.

2.11.5 Prevention of injury at ignition

The method of ignition shall be such that it is not necessary to place the hand in a position where injury may occur when ignition takes place.

2.11.6 Burners interconnected by flues or passages

When two or more burners are enclosed in the same compartment or compartments that are interconnected by flues or other passages, the gas system shall be so designed that unburnt gas cannot be discharged from one burner while the other is alight, except in the case of initial lighting of a burner fitted with a flame safeguard.

2.11.7 Proving ignition

It shall be possible to prove that a burner or pilot is alight when the appliance is in operation in the installed position.

2.11.8 Manually operated burners enclosed in a compartment

Where manually operated burners are enclosed in a compartment in which an explosive accumulation of gas can occur it shall be necessary to open the compartment to light the burner (unless an adequate interlock purge is provided).

2.11.9 Dismantling and replacement by user

Any dismantling or assembly required by the user following the instructions provided shall be easily carried out without undue force. Any replacement shall not require undue force, and incorrect replacement shall be either impossible or completely obvious.

2.11.10 Sharp edges

Parts with which the installer, serviceman or user is likely to come in contact, shall not have sharp points or edges.

2.11.11 Handles and knobs

Handles and knobs shall be so designed as to minimise accidental touching of hot surfaces.

2.12 PRESSURE REGULATORS

2.12.1 Provision of pressure regulators

A certified gas pressure regulator shall be provided with each appliance intended for operation on NG, TG, and TLP. Where practicable the regulator should be fitted within the perimeter of the appliance. Regulator outlet pressures nominated by the appliance manufacturer shall not exceed:

- (a) TG, TLP: 0.63 kPa.
- (b) NG: 1.00 kPa.

2.12.2 Positioning of regulators

Regulators shall be placed such that breather holes cannot easily be blocked, and overheating and the possibility of ignition of gas leaking from the breather holes are minimised.

2.13 MARKINGS

2.13.1 Markings on packaging

The packing case of every appliance shall be marked in a prominent position with the following:

- (a) 'TO BE INSTALLED ONLY BY AN AUTHORIZED PERSON'.
- (b) Maximum packaged weight in kilograms.
- (c) Type of gas for which the appliance has been manufactured.

2.13.2 Gas type label

A label shall be firmly attached in a prominent position on each appliance stating the type of gas for which it has been manufactured and adjusted. Its colour shall be that appropriate to the gas specified as shown in the schedule in Clause 2.13.3.

For appliances intended for use with a flexible connection to a fixed gas supply system, additional wording shall refer to the local gas supplier for confirmation of the gas type, if in doubt.

2.13.3 Gas type colour code

Where a colour code only is used to indicate the type of gas for which an appliance or component is to be used, it shall comply with the following:

- (a) NG: Black.
- (b) TG: Dark Blue.
- (c) Universal LPG: Signal Red.
- (d) Propane only: Orange.
- (e) Butane only: Grass Green.
- (f) TLP: Pink.
- (g) All gases: Primrose.

2.13.4 Identification of injectors

Removable injectors shall carry an identifying cipher, or alternatively the injector size shall be nominated on the data plate. The cipher shall be in the form of numerals indicating the orifice size in millimetres or the BS number of the injector. In the case of pilot injectors a colour coding in accordance with Clause 2.13.3 is also acceptable.

2.13.5 Marking of fans

The direction of rotation of fans shall be clearly and permanently marked where incorrect fitting of a fan is possible.

2.13.6 Other permanent markings on appliances

Appliances shall be provided with clear and permanent markings readily accessible and easy to read and such markings shall include the following:

- (a) Manufacturer's trade name.
- (b) Model designation.
- (c) Month and year of manufacture or serial number where this is documented to show month and year of manufacture.
- (d) Gas or gases for which the appliance is intended to be used.
- (e) Nominal gas consumption in MJ/h, test point pressures in kPa for each gas nominated in (d) above.
- (f) For main burners with an adjustable bypass and which are ignited by a pilot, the main burner test point pressure in kPa at the bypass rate for each gas nominated in (d) above.
- (g) Electrical markings as required by the appropriate electricity authority.
- (h) Wiring diagrams except where electrical equipment is limited to one electric lamp.
- (i) The certificate of compliance number.
- (j) The appropriate warning label as shown in Figure A5. This label should be located on the outside of the appliance in a position where it is clearly visible to the user when operating the appliance in the installed position.
- (k) Any additional information called for in other sections of this Standard.
- (l) Instructions as required in Clause 2.14.3.4.
- (m) Maximum working water pressure in kPa or MPa.
- (n) Minimum working water pressure (water heaters equipped with water-operated gas valves).
- (o) Heat output in kW.

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- (p) Where an appliance is required to be installed on a non-combustible floor, the marking:
- (q) 'TO BE INSTALLED ON A FIREPROOF BASE'.
- (r) A warning: REFER TO OPERATING INSTRUCTIONS FOR APPROVED WATER TREATMENT(S).

2.13.7 Indication of function

The OFF position of all gas valves shall be clearly indicated. Gas valves serving more than one function shall have the position of each function including any special lighting position clearly indicated.

2.13.8 Marking of doors and covers

Those doors, covers, and other components that must be left open, closed or removed during operation shall be indicated with a permanent marking. Access panels that must be left in position during operation shall be indicated by a permanent marking.

2.13.9 Interference with flueing

If the removal of any part of an appliance could cause interference with flueing or the entry of combustion air, suitable temporary warning stickers shall be attached to the appliance.

2.13.10 Point of ignition on flash lighting tubes

Flash lighting tubes that are used for the manual ignition of burners shall have the point of ignition suitably marked, unless this is obvious.

2.13.11 Identification of valve controls

Each valve, including pilot valves, shall be identified with the burner it controls.

2.13.12 Identification of water inlet and outlet

Water inlet and outlet connections shall be clearly identified.

2.13.13 Correct marking of variable setting thermostats

Variable setting thermostats on appliances shall clearly indicate direction of movement required to raise or lower temperature.

Variable setting thermostats shall have a marking corresponding to 25°C for calibration purposes.

2.13.14 Warning to fit temperature or pressure relief valve if not fitted by manufacturer

A warning notice, immediately adjacent to the temperature and pressure relief valve location, to fit the valve when this has not been fitted by the manufacturer.

2.13.15 Appropriate markings for installation type

The appliance shall be marked

'FOR INDOOR INSTALLATION ONLY'

or

'FOR OUTDOOR INSTALLATION ONLY'

as appropriate.

2.14 INSTRUCTIONS

NOTE: All dimensional details are to be in metric terms.

2.14.1 Documents remaining with user

Any document referencing servicing instructions, supplied with the appliance and remaining with the consumer, shall contain a warning that servicing shall be carried out only by authorized personnel.

2.14.2 Installer/User

2.14.2.1 *Instructions supplied with the appliance*

Each appliance shall be supplied with written and diagrammatic installation instructions that include reference to at least the following:

- (a) Model or type of appliance.
- (b) Gas or gases for which the appliance is intended and data such as gas consumption, pressures, etc and reference to the appliance data plate.
- (c) The requirements of the local authority—local gas fitting regulations, municipal building codes, electrical wiring regulations, and any other relevant statutory regulations.
- (d) Overall dimensions of the appliance and location by measurement of connecting points of gas, water, electricity, flues, etc.
- (e) The alternative types of installation/use.
- (f) Details of the methods of connection, including size and type, and alternatives.
- (g) Required clearances from combustible materials. e.g. overhead structures, walls, wall openings, floors, furniture, fixtures and plants.
- (h) Special conditions of installation/use, that may be required as the result of the Certification Test, e.g. whether the appliance is to be protected from rain.
- (i) Special conditions that must be avoided, e.g. marine environment, and any conditions necessary to ensure optimum performance.
- (j) Details of any assembly work required to be done by the installer.
- (k) Definite instructions to test the operation of the appliance before leaving.
- (l) Details of the necessary testing and instructions for minor adjustments.
- (m) Instructions on the procedure to be adopted if the appliance cannot be adjusted to perform safely and correctly.
- (n) Explicit instructions to the installer to test the operation of the appliance after installation.
- (o) Specific instructions for electrical connections if necessary.
- (p) Removal of any transit protection.
- (q) For appliances designed for installation to fixed gas supply systems— AS 5601/AG 601.
- (r) Fitting of temperature and pressure relief valve(s) where applicable.

2.14.3 Operating

2.14.3.1 *Operating instructions supplied with appliance*

Operating instructions shall be supplied with each appliance, covering each separate function of the appliance and such cleaning, assembly and dismantling as is necessary for the user. For programmed appliances, these instructions shall include a clear explanation of programming and the effect of any power supply interruption. Drafts of these instructions shall be submitted with the appliance for certification.

2.14.3.2 *Abnormal operation, maintenance schedule, service and replacement parts*

The instructions shall—

- (a) assist the user to recognize abnormal operation that requires service;
- (b) recommend a maintenance schedule for the life expectancy of the appliance;
- (c) include a reference as to where service and any necessary replacement parts may be obtained; and
- (d) state clearly the water quality parameters for the appliance and the frequency of testing.

2.14.3.3 *Warning statement*

The instructions shall contain the statement:

‘DO NOT PLACE ARTICLES ON OR AGAINST THIS APPLIANCE.

DO NOT USE OR STORE FLAMMABLE MATERIALS NEAR THIS APPLIANCE.

DO NOT SPRAY AEROSOLS IN THE VICINITY OF THIS APPLIANCE WHILE IT IS IN OPERATION.’

2.14.3.4 *Hazardous condition resulting from incorrect lighting and shutdown procedures*

Where incorrect lighting and shutdown procedures can result in a hazardous condition, appliances shall be provided with clearly defined and complete instructions to warn the user of the potential consequences of improper lighting procedures. Where necessary, lighting instructions shall require a safe delay before the appliance is re-lit.

2.14.4 **Servicing****2.14.4.1** *Servicing instructions and maintenance schedule*

Servicing instructions shall be available and they shall include reference to—

- (a) removal of covers and other parts for access to all components;
- (b) removal of components for service—
 - (i) burner equipment;
 - (ii) pilot and flame safeguard;
 - (iii) ignition system;
 - (iv) thermostat;
 - (v) combination control; and
 - (vi) water controls;
- (c) parts replacement—
 - (i) fan;
 - (ii) over-temperature cut-out device; and
 - (iii) heat exchanger or cylinder;
- (d) adjustments—
 - (i) pilot;
 - (ii) aeration;
 - (iii) thermostat calibration, where applicable; and
 - (iv) ignition (spark gap);

- (e) fault finding chart; and
- (f) wiring diagram as specified in Clause 2.13.6 (h);

SECTION 3 PRELIMINARY TESTS — LINE GASES

3.1 GENERAL REQUIREMENTS

Before commencing testing in this Section refer to Clause 2.1.1.

3.1.1 Nominal gas consumption

The nominal gas consumption in MJ/h as specified by the manufacturer is the fundamental quantity on which all methods of test are based and is the starting point for all performance requirements.

3.1.2 Test gases

Tests in all parts of this Standard (except Section 4 which requires the use of special gases in addition to those listed here) shall be carried out using the following test gases:

NOTE: See Table 1.1 for characteristics.

- (a) Appliances intended for use with natural gas shall be tested using available natural gas but in the case of dispute or borderline results test gas 'N' shall be used.
- (b) Appliances intended for use with town gas shall be tested using available Town gas but in the case of dispute or borderline results test gas 'D' shall be used.
- (c) Appliances intended for use with propane only shall be tested with test gas 'X'.
- (d) Appliances intended for use with butane only shall be tested with test gas 'Y'.
- (e) Universal LPG appliances are intended for use with Propane, Butane or any mixture of Propane and Butane and shall be tested with test gas 'X' for all performance tests except for Clauses 5.5 and 5.6 where test gas 'Y' shall be used.

NOTE: Nominal gas consumption shall be rated on test gas 'X' and this is the figure to be stated on the appliance data plate.

- (f) Appliances intended for use with tempered LPG shall be tested with test gas 'T'.

3.2 PREPARATION FOR TESTING

3.2.1 General

Before testing, the appliance heater shall be subjected to an examination according to the qualitative requirements of this Standard, to ensure that it does not possess any obvious features that would prevent its certification. If the appliance is not considered satisfactory, no time will be spent in testing until the manufacturer has made the necessary adjustments.

3.2.2 Electrical safety requirements

The appliance shall comply with the following electrical safety requirements:

When the appliance is disconnected from the power supply the measured resistance between the earth pin of the plug and any exposed metal on the appliance shall not exceed 1 ohm for rotating parts and 0.1 ohm for all other parts.

When the appliance is disconnected from the power supply the measured insulation resistance between current carrying conductors and any exposed metal shall not be less than 1 megohm. The resistance for double insulated equipment shall not be less than 10 megohms.

NOTE: All appliance switches shall be in the 'ON' position.

3.2.3 Setting up appliance for testing

The appliance shall be set up in accordance with the manufacturer's instructions unless otherwise specified in this Standard and checked to ensure that gas consumption, aeration, temperature settings and other adjustments have been made in accordance with the manufacturer's recommendations. Adjustments should be made with the test gas that is applicable (see Clause 3.1.2) with the inlet pressure set at normal test gas pressure (see Clause 1.2.57).

3.2.4 Appliance regulator not to be removed during testing

Appliance regulators are to be considered an integral part of the appliance and shall not be removed during tests, unless specifically instructed otherwise.

3.2.5 Protection from accidental draughts

The appliance under test shall be protected from accidental draughts.

3.2.6 Prevention of gas rate variation

Provision shall be made to prevent thermostats, or any other variable restriction in the gas line, from varying during tests except as necessitated by the requirements.

3.2.7 Gas pressure and gas volume test equipment

The following equipment shall be used for the control of testing pressures and the measurement of gas volume:

- (a) A wet test gas meter, which shall be calibrated before use. A graph should be provided showing the error or correction factor of the meter over as wide a range as possible.

NOTES:

- 1 A saturator is used with a wet test gas meter to ensure saturation of the gas.
 - 2 It is permitted to use a calibrated dry gas meter or a calibrated flow meter for test purposes, but in case of dispute, the wet meter shall be the reference standard.
- (b) An adjustable regulator of adequate capacity fitted to the meter inlet.
 - (c) Pressure gauges connected to meter inlet, appliance inlet and pressure test point, to read to the nearest 10 Pa.
 - (d) A thermometer, graduated to at least 0.5°C installed to measure the gas temperature. The meter water temperature gives a sufficiently accurate figure.
 - (e) A barometer to measure atmospheric pressure in the laboratory correct to 30 Pa.
 - (f) A means of determining within 1% the heating value of the gas being used.
 - (g) A means of determining within 2% the relative density of the gas being used.

3.3 GAS LEAKAGE

3.3.1 Gas tightness

The fully assembled appliance shall be gas tight when subjected to an inlet gas pressure of 14.0 kPa.

3.3.2 Gas tightness after testing

The appliance shall be gas tight (as in Clause 3.3.1) at the conclusion of all certification tests.

3.3.3 Control of bleed lines

Bleed lines from diaphragm type automatic valves shall terminate in a location such that—

- (a) ignition of the bleed gas by the main burner or pilot is assured; and

- (b) blockage of the bleed line tip is prevented.

3.4 GAS CONSUMPTION

3.4.1 Tolerance on determined gas consumption

The determined gas consumption in MJ/h of each burner shall be within 5% of nominal gas consumption.

3.4.2 Determined gas consumption of permanent pilots

The determined gas consumption of each continuously burning pilot shall not be more than 0.5 MJ/h except where heat is employed in conjunction with a thermopile or a thermal generator for operating a safety device, in which case it shall not exceed 1.0 MJ/h.

3.5 GAS PRESSURE REGULATORS

3.5.1 Pressure regulator performance

Except for LPG operated appliances, the regulator outlet pressure shall not vary by more than $\pm 20\%$ when the appliance inlet pressure is varied from 1.13 kPa up to 5.0 kPa for NG appliances and 0.75 kPa up to 3.0 kPa for TG and TLP appliances.

3.6 IGNITION AND FLAME SAFEGUARD SYSTEMS

3.6.1 Requirements applicable to all

3.6.1.1 *Aerated pilots*

Aerated pilots when lit back shall either ignite the main burner promptly and without undue noise or cause a shut off valve to close.

Aerated pilots when their primary air opening is closed, shall either ignite the main burner promptly and without undue noise or cause the safety shut off valve to close.

3.6.1.2 *Ignition at reduced pilot rate*

When the pilot flame is turned down to the point where it will just actuate the flame safeguard system, the main burner, operating at any rate at which its control will permit, shall light safely and reliably from that pilot flame.

3.6.1.3 *Multi-port pilots*

Multi-port pilots shall conform to Clauses 3.6.1.1 and 3.6.1.2 with all ports blocked other than the one activating the flame safeguard sensor.

3.6.1.4 *Holding time for thermoelectric flame safeguard*

On carrying out the normal lighting procedure on a manually ignited atmospheric burner protected by a thermoelectric flame safeguard, the flame safeguard shall hold open within 1 min of igniting the operating flame.

3.6.1.5 *Flame safeguard required*

Burner systems ignited by automatically or remotely controlled ignition systems shall be supervised by a certified flame safeguard.

3.6.1.6 *Flame travel at ignition*

Flames shall travel freely to all ports on a burner when gas is ignited on any one port.

3.6.1.7 *Cessation of ignition spark*

The ignition spark or other means of ignition shall cease at the end of the start flame establishment period except where an interrupted pilot is used and then it may continue until the main flame is established, provided that after the pilot flame establishment period is completed, the ignition spark shall not be able to activate the pilot flame detector.

3.6.1.8 *Commencement of ignition after purge period*

Where a pre-ignition purge period is included, the means of ignition shall commence immediately after the purge period is completed.

3.6.1.9 *Proving of start flame*

Gas shall not flow beyond the start flame establishment period unless the start flame has been proven. Where the start rate is less than the maximum rate the start flame shall be proven before the gas rate increases beyond the start flame rate.

3.6.1.10 *Self-check for flame safeguard systems*

Flame safeguard systems other than 'thermoelectric' types shall incorporate a self-check of integral circuitry to prove that the system is not in the flame proved condition prior to start-up.

3.6.1.11 *Flame failure*

Failure of the supervised burner(s) flame shall result in lockout in accordance with Clause 2.8.1.

3.6.1.12 *Flame establishment period for intermittent pilot*

Where an interrupted or intermittent pilot is used, the main flame establishment period shall not exceed 5 s.

3.6.1.13 *Shut off time for flame safeguard system*

The combined time for the flame safeguard system and its associated valves to shut off the gas supply in the event of flame failure at the point of supervision shall not exceed—

- (a) 90 s where atmospheric type main burners are used and the total gas consumption is up to and including 50 MJ/h;
- (b) 60 s where atmospheric type main burners are used and the total gas consumption exceeds 50 MJ/h (up to and including 150 MJ/h);
- (c) 45 s where atmospheric type main burners are used and the total gas consumption exceeds 150 MJ/h up to and including 500 MJ/h; or
- (d) 3 s for all other types of main burner, or up to 6 s provided the appliance meets delayed ignition tests up to twice the flame failure response period.

3.6.2 **Automatic burner ignition systems—Additional requirements**

NOTE: Systems based on permanent pilots are exempted from this Clause.

3.6.2.1 *Atmospheric burners*

3.6.2.1.1 *Start flame establishment period*

The start flame establishment period shall not exceed 5 s except—

- (a) for start gas rates up to 50 MJ/h (15 s); or
- (b) for start gas rates up to 4 MJ/h (90 s).

3.6.2.1.2 *Gas flow rate at ignition*

The gas flow rate at the time of ignition shall meet one of the following criteria—

- (a) the gas flow rate in MJ/h shall not exceed $200 \frac{V}{T}$

where

V is the volume of the combustion chamber in m³ and

T is the start flame establishment period in seconds; and

- (b) the energy released during the start flame establishment period shall not exceed 0.1 MJ; or
- (c) the energy released during the start flame establishment period shall satisfactorily meet delayed ignition tests up to twice the flame establishment period.

NOTE: As this is a safety test under abnormal operation, explosive noise and flame roll-out may be acceptable provided—

- (a) there is no damage to the appliance;
- (b) the burner does not light back; and
- (c) there is no danger to persons or adjacent property.

3.6.2.1.3 *Start flame proving period when gas flow rate exceeds Clause 3.6.2.1.2*

Where the nominal gas consumption of the supervised burner exceeds the maximum gas flow rate permitted in Clause 3.6.2.1.2, then there shall be a start flame proving period of not less than the flame failure response time or 5 s, whichever is the greater.

3.6.2.1.4 *Number of reignition attempts*

The total number of reignition cycles after flame failure, and prior to lockout, shall be limited to 5.

Flame safeguard systems shall respond to flame failure or loss of flame detector signal by initiating a reignition cycle within 2 s.

The first reignition cycle following loss of flame shall comply as follows—

- (a) the ignition source is applied immediately; or
- (b) safety shutdown is followed by a full start cycle including mechanical pre-ignition purge sufficient to ensure that the volume of the purging medium is at least 5 times the purge volume; or
- (c) safety shutdown followed by a delay of not less than 5 min before a reignition attempt.

Subsequent reignition cycles shall be in accordance with (b) or (c) above.

3.6.2.2 *Forced or induced draught burners*

3.6.2.2.1 *Gas flow rate at ignition*

The gas flow rate at the time of ignition shall meet one of the following criteria—

- (a) the gas flow rate in MJ/h shall not exceed $200 \frac{V}{T}$

where

V is the volume of the combustion chamber in m³ and

T is the start flame establishment period in seconds;

or